What is Claimed is:

1. A method for modulating a refractive index of an ion insertion layer in an optical device, the ion insertion layer having a dielectric constant, the dielectric constant having a real portion and an imaginary portion, the method comprising:

providing an ion conduction layer adjacent the ion insertion layer; and

inserting ions from the ion conduction layer into the ion insertion layer;

wherein:

during the inserting, the imaginary portion of the dielectric constant changes from a first value to a second value and the real portion of the dielectric constant changes from a third value to a fourth value at the wavelength of interest or at the operational wavelength; and

the absolute value of the difference between the second value and the first value is less than the absolute value of the difference between the fourth value and the third value.

2. The method of claim 1 wherein the absolute value of the difference between the second value and the first value divided by the absolute value of the difference between the fourth value and the third value is less than 0.40.

3. The method of claim 1 wherein the ion insertion layer is vanadium pentoxide.

4. The method of claim 1 wherein the ion conduction layer comprises a metal oxide.

5. The method of claim 1 wherein the ion conduction layer comprises a metal oxide having lithium.

6. The method of claim 1 wherein the ion conduction layer is Li_2O-P_2O_5-A_bO_x, wherein A_bO_x is selected from the group consisting of WO_3, TiO_2, and Fe_2O_3.

7. The method of claim 1 further comprising:

providing an ion storage layer having a transmissivity, wherein the ion storage layer stores ions for transport across the ion conduction layer and into the ion insertion layer and wherein the transmissivity of the ion storage layer is not substantially changed.

8. The method of claim 7 wherein the ion storage layer is tin oxide.

9. The method of claim 7 further comprising providing a transparent electrically conductive oxide adjacent the ion storage layer.

10. The method of claim 1 wherein the ion insertion layer is vanadium pentoxide, the method further comprising:

emitting an optical signal having a wavelength in the range from about 0.8 microns to about 1.7 microns.

11. The method of claim 1 further comprising providing a transparent electrically conductive oxide adjacent the ion insertion layer.

12. The method of claim 1 further comprising providing a transparent electrically conductive oxide adjacent the ion conduction layer.

13. The method of claim 1 wherein the inserting further comprises applying an electric field across the ion insertion layer and the ion conduction layer.

14. The method of claim 1 further comprising:

extracting the ions from the ion insertion layer into the ion conduction layer, wherein:

during the extracting, the imaginary portion of the dielectric constant changes from a second value to a fifth value and the real portion of the dielectric constant changes from a fourth value to a sixth value at the wavelength of interest or at the operational wavelength;

the absolute value of the difference between the fifth value and the second value is less than 2% of the first value; and

the absolute value of the difference between the sixth value and the fourth value is less than 2% of the third value.

15. The method of claim 1 wherein the ion insertion layer is formed by a process, wherein the process is selected from the group consisting of thermal evaporation, electron beam evaporation, chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or

transition metal oxide materials, and deposition from a melt.

16. The method of claim 1 wherein the ion conduction layer is formed by a process, wherein the process is selected from the group consisting of thermal evaporation, electron beam evaporation, chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or transition metal oxide materials, and deposition from a melt.

17. A method for modulating a refractive index of an ion insertion layer in an optical device, the ion insertion layer having a dielectric constant, the dielectric constant having a real portion and an imaginary portion, the method comprising:

providing an ion conduction layer adjacent the ion insertion layer;

inserting ions from the ion conduction layer into the ion insertion layer; and

extracting the ions from the ion insertion layer into the ion conduction layer;

wherein:

during the inserting, the imaginary portion of the dielectric constant changes from a first value to a second value and the real portion of the dielectric constant changes from a third value to a fourth value;

the absolute value of the difference between the second value and the first value is less than the absolute value of the difference between the fourth value and the third value;

during the extracting, the imaginary portion of the dielectric constant changes from a second value to a fifth value and the real portion of the dielectric constant changes from a fourth value to a sixth value;

the absolute value of the difference between the fifth value and the second value is less than 2% of the first value; and

the absolute value of the difference between the sixth value and the fourth value is less than 2% of the third value.

18. The method of claim 17 wherein the ion insertion layer is formed by a process, wherein the process is selected from the group consisting of thermal evaporation, electron beam evaporation, chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or transition metal oxide materials, and deposition from a melt.

19. The method of claim 17 wherein the ion conduction layer is formed by a process, wherein the process is selected from the group consisting of thermal evaporation, electron beam evaporation, chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or transition metal oxide materials, and deposition from a melt.

20. A method for modulating a refractive index of an ion insertion layer in an optical device, the refractive index having a real portion and an imaginary portion, the method comprising:

providing an ion conduction layer adjacent the ion insertion layer;

inserting ions from the ion conduction layer to the ion insertion layer; and

wherein:

during the inserting, the real portion changes from a first value to a second value and the imaginary portion changes from a third value to a fourth value;

the difference between the second value and the first value is greater than 0.1;

the difference between the fourth value and the third value is less than 0.2.

21. The method of claim 20 wherein the ion insertion layer is vanadium pentoxide.

22. The method of claim 20 wherein the ion conduction layer comprises a metal oxide.

23. The method of claim 20 wherein the ion conduction layer comprises a metal oxide having lithium.

24. The method of claim 20 wherein the ion conduction layer is Li_2O-P_2O_5-A_bO_x, wherein A_bO_x is selected from the group consisting of WO_3, TiO_2, and Fe_2O_3.

25. The method of claim 20 further comprising:

providing an ion storage layer having a transmissivity, wherein the ion storage layer stores ions for transport across the ion conduction layer and into the ion insertion layer and wherein the transmissivity of the ion storage layer is not substantially changed.

26. The method of claim 25 wherein the ion storage layer is tin oxide.

27. The method of claim 20 further comprising providing a transparent conductive oxide adjacent the ion storage layer.

28. The method of claim 20 wherein the ion insertion layer is vanadium pentoxide, the method further comprising:

emitting an optical signal having a wavelength in the range from about 0.8 microns to about 1.7 microns.

29. The method of claim 20 further comprising providing a transparent conductive oxide adjacent the ion insertion layer.

30. The method of claim 20 further comprising providing a transparent conductive oxide adjacent the ion conduction layer.

31. The method of claim 20 wherein the inserting further comprises applying an electric field across the ion insertion layer and the ion conduction layer.

32. The method of claim 20 further comprising extracting the ions from the ion insertion layer into the ion conduction layer.

33. The method of claim 20 wherein the ion insertion layer is formed by a process, wherein the process is selected from the group consisting of thermal evaporation, electron beam evaporation, chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or transition metal oxide materials, and deposition from a melt.

34. The method of claim 20 wherein the ion conduction layer is formed by a process, wherein the process is selected from the group consisting of thermal evaporation, electron beam evaporation, chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or transition metal oxide materials, and deposition from a melt.

35. A method for modulating the refractive index of an ion insertion layer in an optical device, the ion insertion layer having a bandgap energy (E_g), the method comprising:

providing an ion conduction layer adjacent the ion insertion layer, the ion conduction layer comprising ions;

illuminating the ion insertion layer with photons having sub-bandgap energy; and

inserting the ions into the ion insertion layer to change the refractive index in response to applying an electric field.

36. The method of claim 35 wherein the sub-bandgap energy is between about $0.5E_g$ and about $0.75E_g$.

37. The method of claim 35 wherein the ion insertion layer is formed by a process, wherein the process is selected from the group consisting of thermal evaporation, electron beam evaporation, chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or transition metal oxide materials, and deposition from a melt.

38. The method of claim 35 wherein the ion conduction layer is formed by a process, wherein the process is selected from the group consisting of thermal evaporation, electron beam evaporation, chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or transition metal oxide materials, and deposition from a melt.

39. An iono-refractive device comprising:

an ion conduction material; and

an ion insertion material adjacent the ion conduction material, the ion insertion material having a refractive index, the refractive index having a real portion and an imaginary portion;

wherein:

upon insertion of ions from the ion conduction layer into the ion insertion layer, the real portion of the refractive index changes from a first value to a second value and the real portion of the dielectric constant changes from a third value to a fourth value; and

the absolute value of the difference between the second value and the first value is less than the absolute value of the difference between the fourth value and the third value.

40. The device of claim 39 wherein the ion insertion layer is vanadium pentoxide.

41. The device of claim 39 wherein the ion conduction layer comprises a metal oxide.

42. The device of claim 39 wherein the ion conduction layer comprises a metal oxide having lithium.

43. The device of claim 39 wherein the ion conduction layer is Li_2O-P_2O_5-A_bO_x, wherein A_bO_x is selected from the group consisting of WO_3, TiO_2, and Fe_2O_3.

44. The device of claim 39 further comprising an ion storage layer.

45. The device of claim 44 wherein the ion storage layer is tin oxide.

46. The device of claim 44 further comprising a transparent conductive oxide layer adjacent the ion storage layer.

47. The device of claim 39 further comprising a transparent conductive oxide layer adjacent the ion conduction layer.

48. The device of claim 39 further comprising a transparent conductive oxide layer adjacent the ion insertion layer.

49. An iono-refractive device comprising:

an ion conduction material; and

an ion insertion material adjacent the ion conduction material, the ion insertion material having a refractive index, the refractive index having a real portion and an imaginary portion;

wherein upon insertion of ions from the ion conduction layer into the ion insertion layer, the real portion of the refractive index changes by more than about 0.1 and the imaginary portion of the refractive index changes by less than about 0.2.

50. The device of claim 49 wherein the ion insertion layer is vanadium pentoxide.

51. The device of claim 49 wherein the ion conduction layer comprises a metal oxide.

52. The device of claim 49 wherein the ion conduction layer comprises a metal oxide having lithium.

53. The device of claim 49 wherein the ion conduction layer is Li_2O-P_2O_5-A_bO_x, wherein A_bO_x is selected from the group consisting of WO_3, TiO_2, and Fe_2O_3.

54. The device of claim 49 further comprising an ion storage layer.

55. The device of claim 54 wherein the ion storage layer is tin oxide.

56. The device of claim 54 further comprising a transparent conductive oxide layer adjacent the ion storage layer.

57. The device of claim 49 further comprising a transparent conductive oxide layer adjacent the ion conduction layer.

58. The device of claim 49 further comprising a transparent conductive oxide layer adjacent the ion insertion layer.

59. An iono-refractive device comprising:

an ion conduction layer; and

an ion insertion layer adjacent the ion conduction layer, the ion insertion layer having a refractive index and a bandgap energy (E_g), the refractive index having a real portion and an imaginary portion;

wherein:

upon illuminating the ion insertion layer with light having sub-bandgap energy, the real portion of the refractive index changes by more than about 0.1 and the imaginary portion of the refractive index changes by less than about 0.2 in response to applying an electric field.

60. The ion-refractive device of claim 59 wherein the sub-bandgap energy is between about $0.5E_g$ and about $0.75E_g$.

61. An apparatus for modulating a refractive index of an ion insertion layer in an optical device, the ion insertion layer having a dielectric constant, the dielectric constant having a real portion and an imaginary portion, the apparatus comprising:

means for providing an ion conduction layer adjacent the ion insertion layer; and

means for inserting ions from the ion conduction layer into the ion insertion layer; wherein:

during the inserting, the imaginary portion of the dielectric constant changes from a first value to a second value and the real portion of the dielectric constant changes from a third value to a fourth value at the wavelength of interest or at the operational wavelength; and

the absolute value of the difference between the second value and the first value is less than the absolute value of the difference between the fourth value and the third value.

62. The apparatus of claim 61 wherein the ion insertion layer is formed by a process, wherein the process is selected from the group consisting of thermal evaporation, electron beam evaporation, chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or

transition metal oxide materials, and deposition from a melt.

63. The apparatus of claim 61 wherein the ion conduction layer is formed by a process, wherein the process is selected from the group consisting of thermal evaporation, electron beam evaporation, chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or transition metal oxide materials, and deposition from a melt.

64. An apparatus for modulating a refractive index of an ion insertion layer in an optical device, the refractive index having a real portion and an imaginary portion, the apparatus comprising:

means for providing an ion conduction layer adjacent the ion insertion layer; and

means for inserting ions from the ion conduction layer to the ion insertion layer; wherein:

during the inserting, the real portion changes from a first value to a second value and the imaginary portion changes from a third value to a fourth value;

the absolute value of the difference between the second value and the first value is greater than 0.1; and

the absolute value difference between the fourth value and the third value is less than 0.2.

65. The apparatus of claim 64 wherein the ion conduction layer is formed by a process, wherein

the process is selected from the group consisting of thermal evaporation, electron beam evaporation, chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or transition metal oxide materials, and deposition from a melt.

66. The apparatus of claim 64 wherein the ion conduction layer is formed by a process, wherein the process is selected from the group consisting of thermal evaporation, electron beam evaporation, chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or transition metal oxide materials, and deposition from a melt.

67. An apparatus for modulating the refractive index of an ion insertion layer in an optical device, the ion insertion layer having a bandgap energy (E_g), the apparatus comprising:

means for providing an ion conduction layer adjacent the ion insertion layer, the ion conduction layer comprising ions;

means for illuminating the ion insertion layer with photons having sub-bandgap energy; and

means for inserting the ions into the ion insertion layer to change the refractive index.

68. The apparatus of claim 67 wherein the ion insertion layer is formed by a process, wherein the process is selected from the group consisting of thermal evaporation, electron beam evaporation,

chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or transition metal oxide materials, and deposition from a melt.

69. The apparatus of claim 67 wherein the ion conduction layer is formed by a process, wherein the process is selected from the group consisting of thermal evaporation, electron beam evaporation, chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or transition metal oxide materials, and deposition from a melt.

70. A method for modulating a refractive index of an ion insertion layer in an optical device, the refractive index having a real portion and an imaginary portion, the method comprising:

providing the ion insertion layer that is weakly electrochromic;

providing an ion conduction layer adjacent the ion insertion layer; and

inserting ions from the ion conduction layer into the ion insertion layer;

wherein:

during the inserting, the real portion changes from a first value to a second value and the imaginary portion changes from a third value to a fourth value;

the absolute value of the difference between the second value and the first value is greater than 0.1; and

the absolute value of the difference between the fourth value and the third value is less than 0.2.

71. The method of claim 70 wherein the ion insertion layer is formed by a process, wherein the process is selected from the group consisting of thermal evaporation, electron beam evaporation, chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or transition metal oxide materials, and deposition from a melt.

72. The method of claim 70 wherein the ion conduction layer is formed by a process, wherein the process is selected from the group consisting of thermal evaporation, electron beam evaporation, chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or transition metal oxide materials, and deposition from a melt.

73. A method for modulating a refractive index of an ion insertion layer in an optical device, the ion insertion layer having a lattice structure, the refractive index having a real portion and an imaginary portion, the method comprising:

providing an ion conduction layer adjacent the ion insertion layer; and

inserting ions from the ion conduction layer into the ion insertion layer;

wherein:

during the inserting, the lattice structure of the ion insertion layer changes and the real portion changes from a first value to a second value and the imaginary portion changes from a third value to a fourth value;

the absolute value of the difference between the second value and the first value is greater than 0.1; and

the absolute value of the difference between the fourth value and the third value is substantially diminished in response to changing the lattice structure.

74. The method of claim 73 wherein the ion insertion layer is formed by a process, wherein the process is selected from the group consisting of thermal evaporation, electron beam evaporation, chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or transition metal oxide materials, and deposition from a melt.

75. The method of claim 73 wherein the ion conduction layer is formed by a process, wherein the process is selected from the group consisting of thermal evaporation, electron beam evaporation, chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or transition metal oxide materials, and deposition from a melt.

76. A method for modulating a refractive index of an ion insertion layer in an optical device, the refractive index having a real portion and an imaginary portion, the method comprising:

providing an ion conduction layer adjacent the ion insertion layer;

annealing the ion insertion layer in an oxygen atmosphere; and

inserting the ions from the ion conduction layer into the ion insertion layer; wherein:

during the inserting, the real portion changes from a first value to a second value and the imaginary portion changes from a third value to a fourth value;

the absolute value of the difference between the second value and the first value is greater than 0.1; and

the absolute value of the difference between the fourth value and the third value is substantially diminished in response to annealing the ion insertion layer.

77. The method of claim 76 wherein the ion insertion layer is formed by a process, wherein the process is selected from the group consisting of thermal evaporation, electron beam evaporation, chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or transition metal oxide materials, and deposition from a melt.

78. The method of claim 76 wherein the ion conduction layer is formed by a process, wherein the process is selected from the group consisting of thermal evaporation, electron beam evaporation, chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or transition metal oxide materials, and deposition from a melt.

79. A Fabry-Perot etalon filter, the filter comprising:

a first partially reflecting mirror;

a spacer adjacent the first partially reflecting mirror, wherein the spacer is between the first partially reflecting mirror and a second partially reflecting mirror;

an ion conduction layer formed on the spacer;

an ion insertion layer that has a dielectric constant and that is adjacent to the ion conduction layer; and

a controller that applies an electric field across the ion conduction layer and the ion insertion layer, wherein the applied electric field inserts ions from the ion conduction layer into the ion insertion layer while not substantially altering the transmissivity;

wherein the dielectric constant of the ion insertion layer changes in response to the electric field and modulates a light beam entering the filter.

80. The filter of claim 79, wherein:

the ion insertion layer has a dielectric constant, the dielectric constant has a real portion and an imaginary portion;

during the inserting, the real portion changes from a first value to a second value and the imaginary portion changes from a third value to a fourth value;

the absolute value of the difference between the second value and the first value is less than the absolute value of the difference between the fourth value and the third value.

81. The filter of claim 79 wherein the first partially reflecting mirror comprises a first dielectric material of a first refractive index and a second dielectric material of a second refractive index.

82. The filter of claim 79 wherein the first dielectric material is lithium orthophosphate and the second dielectric material is vanadium oxide.

83. The filter of claim 79 wherein the ion insertion layer is formed by a process, wherein the process is selected from the group consisting of thermal evaporation, electron beam evaporation, chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or transition metal oxide materials, and deposition from a melt.

84. The filter of claim 79 wherein the ion conduction layer is formed by a process, wherein the process is selected from the group consisting of thermal evaporation, electron beam evaporation, chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or transition metal oxide materials, and deposition from a melt.

85. An optical device, comprising:

an optical source that generates a light beam;

a Fabry-Perot etalon coupled to the optical source that receives and modulates the light beam by changing a refractive index of an ion insertion layer in the etalon, wherein the etalon comprises:

a pair of partially reflecting mirrors;

a spacer located between the pair of partially reflecting mirrors;

an ion conduction layer formed on the spacer;

the ion insertion layer adjacent the ion conduction layer, the refractive index of the ion insertion layer having a real portion and an imaginary portion; and

a controller that applies an electric field across the ion conduction layer and the ion insertion layer, wherein:

the applied electric field inserts ions from the ion conduction layer into the ion insertion layer;

during the inserting, the real portion of the refractive index changes from a first value to a second value and the imaginary portion changes from a third value to a fourth value;

the absolute value of the difference between the second value and the first value is greater than 0.1; and

the absolute value of the difference between the fourth value and the third value is less than 0.2.

86. A method of modulating a refractive index in an optical device, the method comprising:

providing a pair of partially reflecting mirrors;

providing a spacer located between the pair of partially reflecting mirrors;

providing an ion conduction layer on the spacer;

providing an ion insertion layer adjacent the ion conduction layer; and

inserting ions from the ion conduction layer into the ion conduction layer;

wherein:

the ion insertion layer has a refractive index, the refractive index having a real portion and an imaginary portion;

during the inserting, the real portion of the refractive index changes from a first value to a second value and the imaginary portion changes from a third value to a fourth value;

the absolute value of the difference between the second value and the first value is greater than 0.1; and

the absolute value of the difference between the fourth value and the third value is less than 0.2.

87. A tunable optical device, comprising:

a substrate;

a waveguide formed on the substrate that guides a propagating light beam;

an iono-refractive structure formed on at least a portion of the waveguide that includes an ion insertion layer and an ion conduction layer; and

a controller that applies an electric field across the ion conduction layer and the ion insertion layer, wherein the applied electric field inserts ions from the ion conduction layer into the ion insertion layer;

wherein the dielectric constant of the ion insertion layer changes in response to the electric field and modulates the light beam in the waveguide.

88. The device of claim 87 wherein the iono-refractive structure is further configured to change the phase of the light beam in the waveguide.

89. The device of claim 87 wherein the iono-refractive structure is further configured to change the direction of the light beam in the waveguide.

90. The device of claim 87 further comprising a circular electrode formed on the ion insertion layer.

91. The device of claim 90 wherein the iono-refractive structure is further configured to focus the light beam in the waveguide in response to applying an electric field to the circular electrode.

92. The device of claim 90 further comprising a sheet electrode formed beneath the ion conduction layer, wherein the iono-refractive structure is further configured to focus the light beam in the waveguide in response to applying an electric field between the circular electrode and the sheet electrode.

93. A multiple wavelength output light source, comprising:

a laser that outputs a plurality of wavelengths and that has an optical mode at the surface of the laser;

an iono-refractive structure formed at the surface of the laser, wherein the iono-refractive structure includes an ion conduction layer and an ion insertion layer; and

a controller that applies an electric field across the ion conduction layer and the ion insertion layer, wherein the applied electric field inserts ions from the ion conduction layer into the ion insertion layer;

wherein the dielectric constant of the ion insertion layer changes in response to the electric field and modulates one of the plurality of wavelengths from the laser.

94. The light source of claim 93 wherein the ion insertion layer is formed by a process, wherein the process is selected from the group consisting of thermal evaporation, electron beam evaporation, chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or transition metal oxide materials, and deposition from a melt.

95. The light source of claim 93 wherein the ion conduction layer is formed by a process, wherein the process is selected from the group consisting of thermal evaporation, electron beam evaporation, chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or transition metal oxide materials, and deposition from a melt.

96. A tunable light source, comprising:

a laser that generates an output wavelength and that has an optical mode at the surface of the laser;

an iono-refractive structure formed at the surface of the laser that includes an ion conduction layer and an ion insertion layer;

a controller that applies an electric field across the ion conduction layer and the ion insertion layer, wherein the applied electric field inserts ions from the ion conduction layer into the ion insertion layer;

wherein the dielectric constant of the ion insertion layer changes in response to the electric field and modulates the output wavelength.

97. The tunable light source of claim 96 wherein the ion insertion layer is formed by a process, wherein the process is selected from the group consisting of thermal evaporation, electron beam evaporation, chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or transition metal oxide materials, and deposition from a melt.

98. The tunable light source of claim 96 wherein the ion conduction layer is formed by a process, wherein the process is selected from the group consisting of thermal evaporation, electron beam evaporation, chemical vapor deposition, plasma enhanced chemical vapor deposition, magnetron sputtering, ion sputtering, sol-gel deposition, co-deposition with polymeric or transition metal oxide materials, and deposition from a melt.

99. The device of claim 96 wherein:

the ion insertion layer has a refractive index, the refractive index having a real portion and an imaginary portion;

during the inserting, the real portion of the refractive index changes from a first value to a second value and the imaginary portion changes from a third value to a fourth value;

the absolute value of the difference between the second value and the first value is greater than 0.1; and

the absolute value of the difference between the fourth value and the third value is less than 0.2.

100. The device of claim 96 wherein the laser is a diode laser.